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Applicant : Christopher Gordon Gervase
TURNER

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Serial No. : 09/877,438

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Title : SIDEBAND DIVERSITY READER FOR ELECTRONIC IDENTIFICATION
SYSTEM

Commissioner for Patents
Washington, D.C. 20231

TRANSMITTAL OF PRIORITY DOCUMENT UNDER 35 USC §119

SIR:

Applicant hereby claims the priority date of South African Application No. 2000/2938 filed on June 12, 2000.

A certified copy of said application from which priority is claimed is submitted herewith.

Please apply any charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: 29 Aug. 01

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CERTIFICATE OF MAILING BY FIRST CLASS MAIL

I hereby certify under 37 CFR §1.8(a) that this correspondence is being deposited with the United States Postal Service as first class mail with sufficient postage on the date indicated below and is addressed to the Commissioner for Patents, Washington, D.C. 20231.

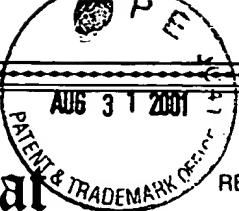
29 Aug. 2001

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Signature

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Sertifikaat

PATENTKANTOOR

DEPARTEMENT VAN HANDEL
EN NYWERHEID

REPUBLIEK VAN SUID-AFRIKA



REPUBLIC OF SOUTH AFRICA

Certificate

PATENT OFFICE

DEPARTMENT OF TRADE
AND INDUSTRY

Hiermee word gesertifiseer dat
This is to certify that

- 1) South African Patent Application No. **2000/2938** accompanied by a Provisional Specification was filed at the South African Patent Office on the 12 June 2000, in the name of **SUPERSENSOR (PROPRIETARY) LIMITED** in respect of an invention entitled: "**SIDEBAND DIVERSITY READER FOR ELECTRONIC IDENTIFICATION SYSTEM**".
- 2) The photocopy attached hereto is a true copy of the provisional specification and drawings filed with South African Patent Application No. **2000/2938**.

**CERTIFIED COPY OF
PRIORITY DOCUMENT**

Geteken te PRETORIA in die Republiek van Suid-Afrika, hierdie
Signed at PRETORIA in the Republic of South Africa, this

21 dag van
day of

JUNE 2001

S. J. Snyman
Registrer van Patente
Registrár of Patents

REPUBLIC OF SOUTH AFRICA

PATENTS ACT, 1978

P/00/78408

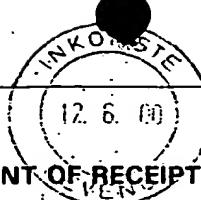
REGISTER OF PATENTS			
OFFICIAL APPLICATION NO.		LODGING DATE : PROVISIONAL	ACCEPTANCE DATE
21	01	20002938	22 12-06-2000 43
INTERNATIONAL CLASSIFICATION		LODGING DATE : COMPLETE	
51		23	47
FULL NAME(S) OF APPLICANT(S)/PATENTEE(S)			
71	SUPERSENSOR (PROPRIETARY) LIMITED		
APPLICANTS SUBSTITUTED:			DATE REGISTERED
71			
ASSIGNEE(S)			DATE REGISTERED
71			
FULL NAME(S) OF INVENTOR(S)			
72	TURNER, Christopher Gordon Gervase		
PRIORITY CLAIMED	COUNTRY	NUMBER	DATE
N.B. Use International abbreviation for country. (See Schedule 4)	33	31	32
TITLE OF INVENTION	SIDEBAND DIVERSITY READER FOR ELECTRONIC IDENTIFICATION SYSTEM		
54			
ADDRESS OF APPLICANT(S)/PATENTEE(S)			
Kernick House Waterfall Park Bekker Road Midrand			
ADDRESS FOR SERVICE	DMK		P/00/78408
74 D.M. KISCH INC., SANDTON			
PATENT OF ADDITION NO.		DATE OF ANY CHANGE	
61			
FRESH APPLICATION BASED ON		DATE OF ANY CHANGE	

D.M. KISCH INC., Johannesburg

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

APPLICATION FOR A PATENT AND ACKNOWLEDGEMENT OF RECEIPT
(Section 30 (1) - Regulation 22)

The grant of a patent is hereby requested by the undermentioned applicant
on the basis of the present application filed in duplicate.



REPUBLIC VAN
SUID-AFRIKA
Form P.1

740000
REPUBLIC OF
SOUTH AFRICA 445

PATENT APPLICATION NO.			AGENT'S REFERENCE
21	01	20002938	P/00/78408

FULL NAME(S) OF APPLICANT(S)		
71	SUPERSENSOR (PROPRIETARY) LIMITED	

ADDRESS(ES) OF APPLICANT(S)		REGISTRAR OF PATENTS, DESIGNS, TRADE MARKS AND COPYRIGHT
	Kernick House Waterfall Park Bekker Road Midrand	2000 -06- 12
		REGISTRAR VAN PATENTE, MODELE HANDELSMERKE EN GUTEURSREC

TITLE OF INVENTION		
54	SIDEBAND DIVERSITY READER FOR ELECTRONIC IDENTIFICATION SYSTEM	
	THE APPLICANT CLAIMS PRIORITY AS SET OUT ON THE ACCOMPANYING FORM P.2. The earliest priority claimed is	
	THIS APPLICATION IS FOR A PATENT OF ADDITION TO PATENT APPLICATION NO. 21 01	
	THIS APPLICATION IS A FRESH APPLICATION IN TERMS OF SECTION 37 AND BASED ON APPLICATION NO. 21 01	

THIS APPLICATION IS ACCCOMPANIED BY :		
X	1	A single copy of a provisional xxxxx copies of a xx complete specification of 10 pages.
X	2	Drawings of 3 sheets.
	3	Publication particulars and abstract (Form P.8. in duplicate).
	4	A copy of Figure of the drawings for the abstract.
	5	An assignment of invention.
	6	Certified priority document(s) (State number).
	7	Translation of priority document(s).
	8	An assignment of priority rights.
	9	A copy of Form P.2 and specification of S.A. Patent Application No. 21 01
	10	A declaration and power of attorney on Form P.3.
	11	Request for ante-dating on Form P.4.
	12	Request for classification on Form P.9.
	13	

DATED THIS 12 th DAY OF June 2000

Patent Attorney for the Applicant(s)

ADDRESS FOR SERVICE		
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D.M. KISCH INC. , Johannesburg

Form P.6

*Patent Attorneys & Trademark Agents
Attorneys & Notaries*

REPUBLIC OF SOUTH AFRICA

PATENTS ACT, 1978.

PROVISIONAL SPECIFICATION

(Section 30 (1) - Regulation 27)

PATENT APPLICATION NO.		LODGING DATE.		AGENT'S REFERENCE
21	01	20002938	22	12-06-2000
FULL NAME(S) OF APPLICANT(S)				
71	SUPERSENSOR (PROPRIETARY) LIMITED			
FULL NAME(S) OF INVENTOR(S)				
72	TURNER, Christopher Gordon Gervase			
TITLE OF INVENTION				
54	SIDEBAND DIVERSITY READER FOR ELECTRONIC IDENTIFICATION SYSTEM			

20002938

INTRODUCTION AND BACKGROUND

THIS invention relates to electronic radio frequency identification systems and more particularly to a reader or receiver forming part of such a system.

- 5 In known systems of the aforementioned kind, the reader transmits an interrogation signal towards a transponder population. Each transponder comprises an antenna connected to an integrated chip hosting electronic circuitry of the transponder, including a modulator and a controller. In response to the energizing signal, the transponder modulates, by utilizing backscatter modulation, the impinging interrogation signal with digital data to be transmitted to the reader. This is done by the controller causing the modulator to cause a deliberate mismatch between an input impedance of the chip and an impedance of the antenna, in accordance with the digital data to be transmitted.
- 10

15

The resulting signal is an amplitude modulated signal comprising an upper sideband and a lower sideband on either side of a carrier, which is the energizing signal.

- 20 The known readers comprise wideband receivers for receiving both sidebands and converting them directly to baseband utilizing the carrier frequency.

A problem with the known systems is that the broadband receiver is susceptible to noise generated by other transponders or another source (e.g. another similar system, a cellular telephone etc) on either the upper sideband or the lower sideband. Even if one sideband is unaffected, the
5 present readers cannot decode the data received.

OBJECT OF THE INVENTION

Accordingly, it is an object of the present invention to provide a reader or receiver and an associated method with which the applicant believes the
10 aforementioned problems may at least be alleviated.

SUMMARY OF THE INVENTION

According to the invention there is provided a reader for an electronic radio frequency identification system also comprising a plurality of transponders
15 to be read by the reader, the reader comprising:

- means for recovering and separating an upper sideband and a lower sideband of a modulated response signal from one of the transponders; and

- means for automatically selecting one of the upper sideband and the
20 lower sideband for output to a next stage.

The means for recovering and separating the upper sideband and the lower sideband may comprise an image rejecting mixer. The mixer is preferably a

phasing type image rejecting mixer and the upper sideband may be provided at a first output thereof and the lower sideband at a second output thereof.

The aforementioned next stage may comprise a data decoder.

5

The means for automatically selecting one of the upper sideband and the lower sideband may comprise a processor connected to the decoder and to a switch connected between the mixer and the decoder, the switch being controllable by the processor to select either the first or the second output of the mixer for connection to the decoder.

10

The reader may also comprise means for generating an energizing signal for energizing passive transponders. In the case of active transponders, the signal may be an interrogation signal.

15

The means for generating an energizing signal may also be connected to the image rejecting mixer to convert the response signal down to baseband.

20

The reader may comprise a single antenna for transmitting the energizing signal and receiving response signals modulated by the transponders. The response signals and/or a reflection from the antenna of the energizing signal may be coupled via first and second directional couplers respectively to the image rejecting mixer.

The antenna may be connected to the means for generating an energizing signal via a strip line and the directional couplers may cooperate with the strip line.

- 5 The reader may comprise a second image rejecting mixer having a first input and a second input. The first input of the second mixer may be connected to a directional coupler cooperating with the strip line and which is suitably spaced from the first coupler associated with the first image rejecting mixer. The spacing may be between $\lambda/4$ and $2\lambda/6$, preferably $\lambda/5$.
- 10 The second input of the second mixer may be similarly connected to the means for generating an energizing signal.

The second mixer may comprise a first and a second output for an upper and a lower sideband of an amplitude modulated response signal.

15

The first and second outputs may be connected to a second decoder via a second switch and the decoder may be connected to the processor, the second switch being controllable by the processor to select either the first or the second output of the mixer for connection to the second decoder.

20

The first decoder may have an output connected to a first input of a third switch and the second decoder may have an output connected to a second

input of the third switch, the third switch being operable by the processor to connect an output thereof to either the first input or the second input.

In other embodiments, the first and second inputs of the third switch may
5 be connected to first and second outputs respectively.

Also included within the scope of the present invention is an identification system as herein defined and described.

10 Yet further included within the scope of the present invention is a method of reading a response signal from an electronic RF transponder, the method comprising the steps of:

- receiving the signal;
- utilizing homodyne demodulating techniques to recover and separate
15 an upper sideband and a lower sideband of the signal; and
- utilizing minimum requirements for errors in data in the sidebands and automatically selecting one of the upper sideband and the lower sideband for further processing.

20 **BRIEF DESCRIPTION OF THE ACCOMPANYING DIAGRAMS**

The invention will now further be described, by way of example only, with reference to the accompanying diagrams wherein:

- figure 1 is a block diagram of an electronic radio frequency identification system;
- figure 2 is a block diagram of a reader according to the invention forming part of the system; and
- 5 figure 3 is a block diagram of another embodiment of the reader.

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

An electronic radio frequency (RF) identification system according to the invention is generally designated by the reference numeral 10 in figure 1.

10

The system comprises a reader 12 and a transponder population 14 comprising transponders 14.1 to 14.n. In use the transponders may be mounted on or otherwise associated with items or articles (not shown) to be counted or identified. The transponders may be active transponders comprising their own local power supplies or they may be passive transponders in that they derive power to operate from an energizing signal 16 transmitted by the reader. The transponders are similar in configuration and therefore transponder 14.1 only will be described further. Transponder 14.1 comprises an antenna 18, an integrated circuit 19 connected to the antenna and comprising a modulator 20, a controller 22 and a memory arrangement 24.

In use, the reader transmits an energizing signal 16 towards the transponder population 14. The transponders derive their power from this signal (as hereinbefore described), transmit respective response signals 26.1 to 26.n by backscatter modulating the signal in known manner with a frame of data prestored in memory arrangement 24. The reader sequentially locks onto one of the response signals and reads the data as will hereinafter be described. Once the population has been read, the aforementioned items are identified and/or counted.

- 10 The resulting response signal 26.1 is an amplitude modulated signal comprising upper and lower side bands on either side of a carrier having a frequency f_c .

A first embodiment of the reader 12 according to the invention is shown in figure 2. The reader comprises an antenna 28, a transmitter 30 for the energizing signal 16 having a frequency f_c . The transmitter is connected to the antenna to transmit the energizing signal 16 and is also connected to a phasing type image reject receiver 32. The received response signal 26.1 is directionally coupled at 34 to the image reject receiver 32. An output 36 of the receiver is connected to a discrimination detector 38 and fed back to the image reject circuit via a sideband select control path 40. In use, the discrimination detector 38 detects the presence of noise on any of the two

sidebands and automatically selects the better sideband to be made available as a baseband signal at output 36.

- Another embodiment of the reader is shown in figure 3 and designated 5 112. The reader 112 comprises a frequency synthesizer 114 for generating the energizing signal. The signal may be a monotone signal or may hop in frequency through a frequency band. The output is connected via a first power divider 116 to a power amplifier 118 as well as to a second power divider 120. The output of the amplifier is connected via strip line 121 to 10 antenna 128 via which the energizing signal is transmitted. First and second outputs of the second power divider 120 are connected to the second inputs 124 and 131 respectively of first and second balanced quadrature mixers 130 and 132, of respective balanced image rejecting mixers 134 and 136. The first input 138 of balanced quadrature mixer 15 130 is derived from a directional coupler 140 cooperating with line 121 and which is split by power splitter 142. The first input 146 of balanced quadrature mixer 132 is derived from a directional coupler 146 which is spaced between $\lambda/4$ to $\lambda/6$ (preferably $\lambda/5$) from coupler 140 along line 121.
- 20 At the outputs 150.1 and 150.2 of adder 150 of mixer 134 there are available the lower and upper sidebands respectively of a response signal 26.1 received from transponder 14.1. The lower and upper sidebands of

the signal are also available at outputs 152.1 and 152.2 respectively of adder 152 of mixer 136.

The outputs 150.1 and 150.2 on the one hand and 152.1 and 152.2 on

5 the other are selectable via switches 151 and 153 respectively, by a central processor 154 via sideband selection circuits 156 and 158 respectively.

The selected sideband (upper or lower) in each case is decoded at decoder 160 or 162 to provide decoded data streams.

10 A further switch 164 controlled by central processor 154 enables selection between the aforementioned data streams.

Although the couplers 140 and 146 are spaced along strip line 121 to avoid the effect of nulls in the return path, it is possible that signals from two

15 transponders in the population 14 may be read simultaneously, by providing two outputs for switch 164. The signal from the first transponder is decoded by decoder 160 and that of the second by decoder 162.

It will be appreciated that there are many variations in detail on the reader,

20 system and method according to the invention without departing from the scope and spirit of this disclosure.

Dated this 12 day of June 2000

Patent Attorney / Agent for the Applicant

20002938

SIPERSENSOR (PROPRIETARY) LIMITED

3 SHEETS
SHEET 1

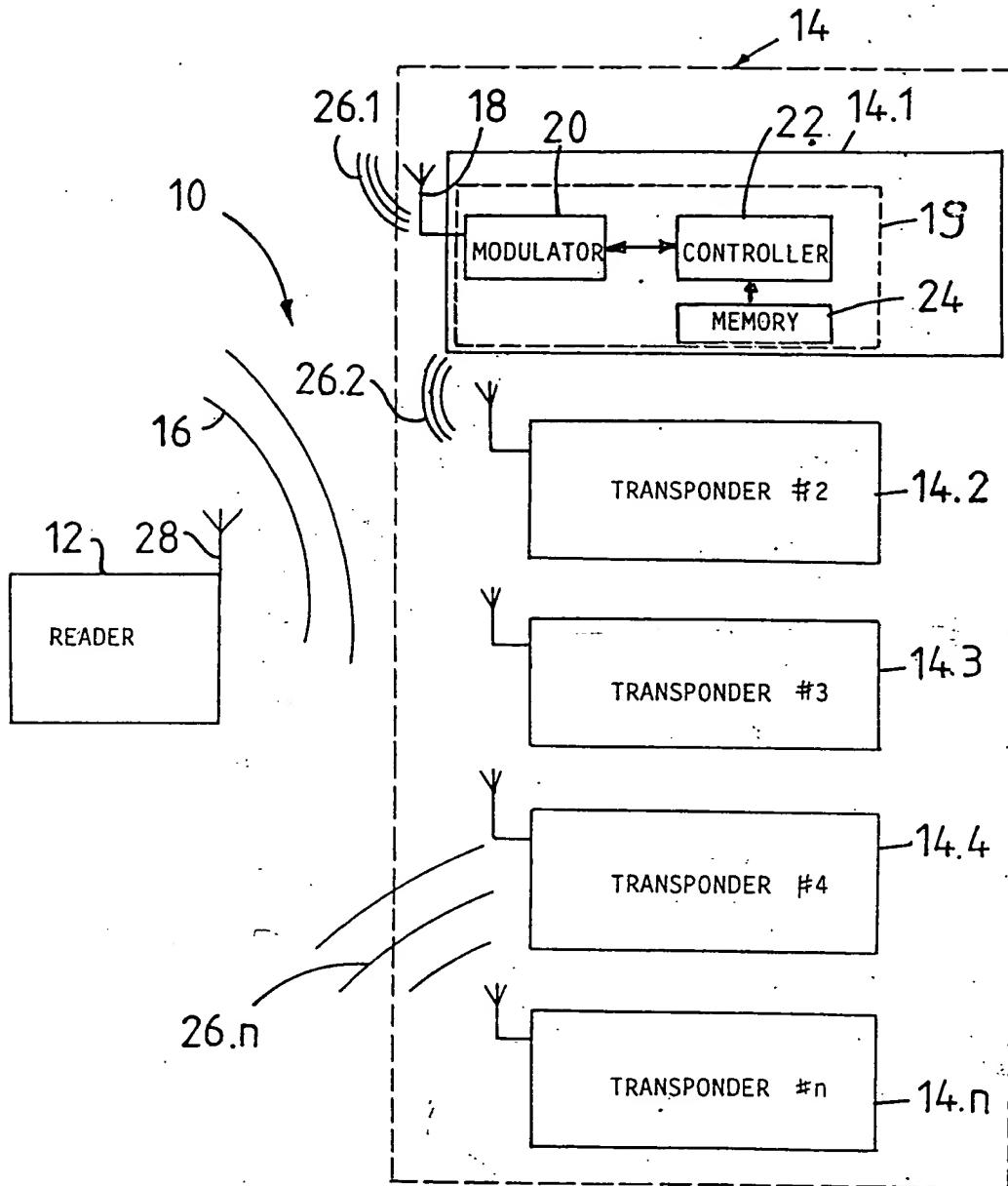


FIGURE 1.

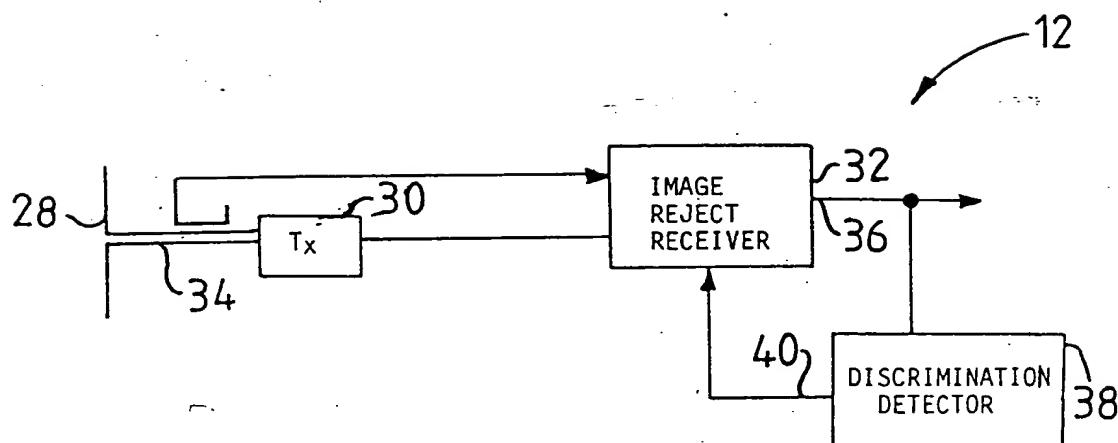


FIGURE 2

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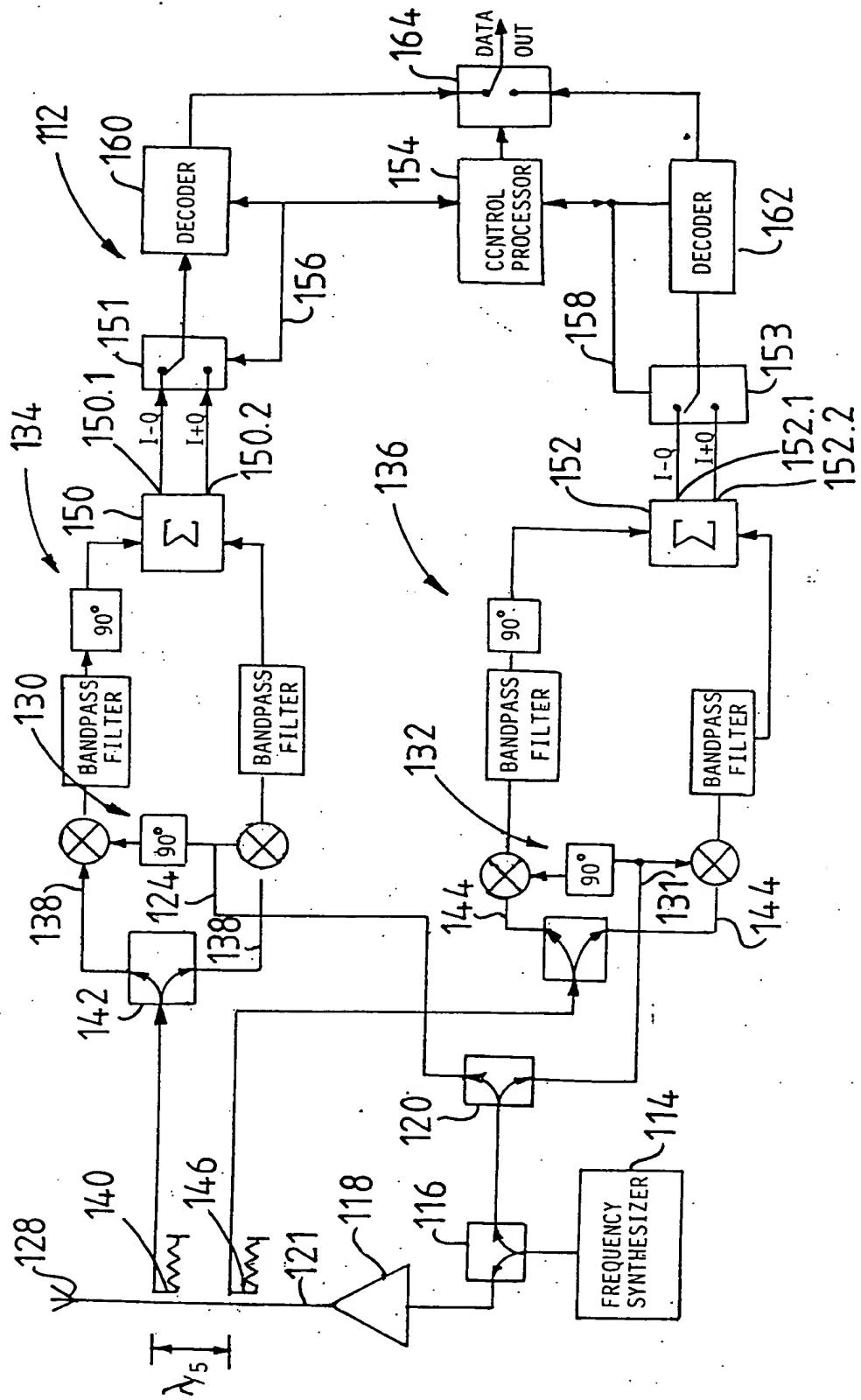
3 SHEETS
SHEET 3

FIGURE 3